Thermal Diffusivity Measurements of Carbon Materials

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We have investigated thermal diffusivity measurement by the laser flash method in order to establish the thermal diffusivity standard. In many cases, thermal conductivity values of bulk materials near room temperature are calculated from thermal diffusivity, specific heat capacity and bulk density. The thermal diffusivity is one of the transport properties. It depends on the material and it is sensitive to the structure. So, it is important to measure thermal diffusivity of each material. The laser flash method is one of the most popular methods of thermal diffusivity measurement for bulk materials above room temperature. According to this background, there is a need for a standard for thermal diffusivity measurement using the laser flash method. The National Metrology Institute of Japan (NMIJ) in AIST has investigated reference materials for laser flash thermal diffusivity measurements. We developed a reference material made by isotropic graphite in 2006. It was supplied as “NMIJ RM 1201-a” since 2006. Subsequently, it has been supplied as the certified reference material “NMIJ CRM 5804a” since 2011. We have investigated some candidate materials to establish another reference material for the laser flash method. For the laser flash method, it is preferable that the material is optically nontransparent and dark colored (ideally black) in order to absorb the light of the pulse heating in a thin surface and to obtain high emissivity for radiative detection of the transient temperature change after the pulse heating. We focused on carbon materials. We measured the thermal diffusivity of some carbon materials, for example, isotropic graphite and pyrolytic graphite. It was found that the inherent thermal diffusivity can be determined over a wide range.